An evaluation of alternative methods of P application for increased maize production under smallholder farmers' conditions in Kenya

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Objective

This study aimed to evaluate the use of alternative P formulations (seed P treatment, foliar P sprays and P fertilizers with fulvic acid conditioners) for effective P supply to maize and increased grain yields in P-deficient soils of smallholder farms in Kenya.

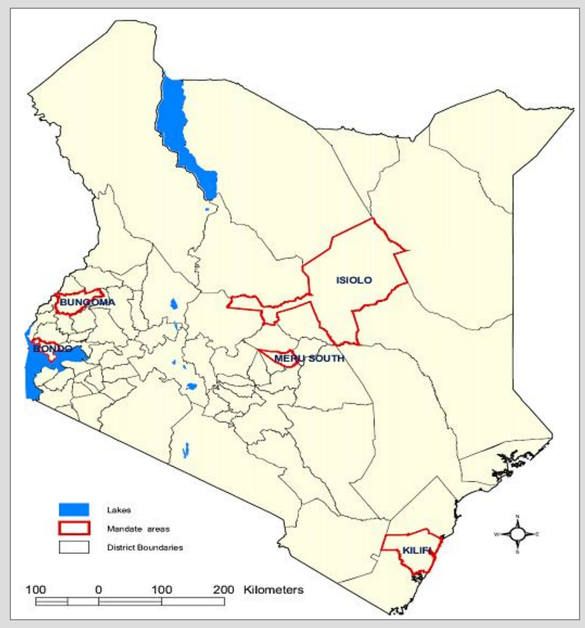
Materials and methods

Pot trials: Evaluation in two representative soils with differing texture and P buffering capacity (PBC).

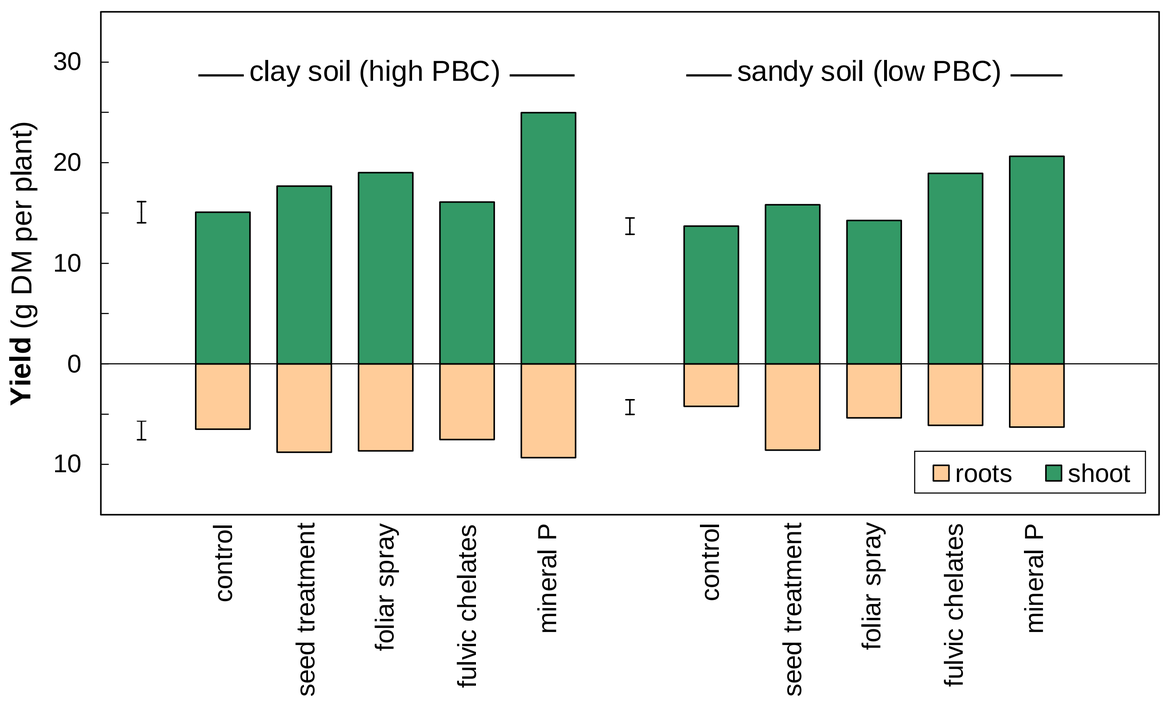
Field trials: Evaluation with 5-7 farmer groups in 5 different agro-ecologies during 2 subsequent seasons, using a multi-locational, one farmer = one replicate design.

Products included a seed treatment (Teprosyn Zn/P, Yara Int.), a foliar fertilizer (Agroleaf Power high P, Scotts Int.) and a P concentrate with fulvic chelates for increased P availability (Turbotop, Lachlan Ltd.), and were applied following recommended procedure. Since P additions were small and only aim to supply P for initial growth or as a top-up, additional TSP fertilizer was applied at planting at half the recommended rate (HR: 13-30 kg P ha^{-1}, depending on the agro-ecological conditions).

All other nutrients (in pot trials) and N and K (in field trials) were applied at optimal rates to ensure that P is the only limiting nutrient. A treatment with TSP at full recommended rate (FR) was included for comparison.

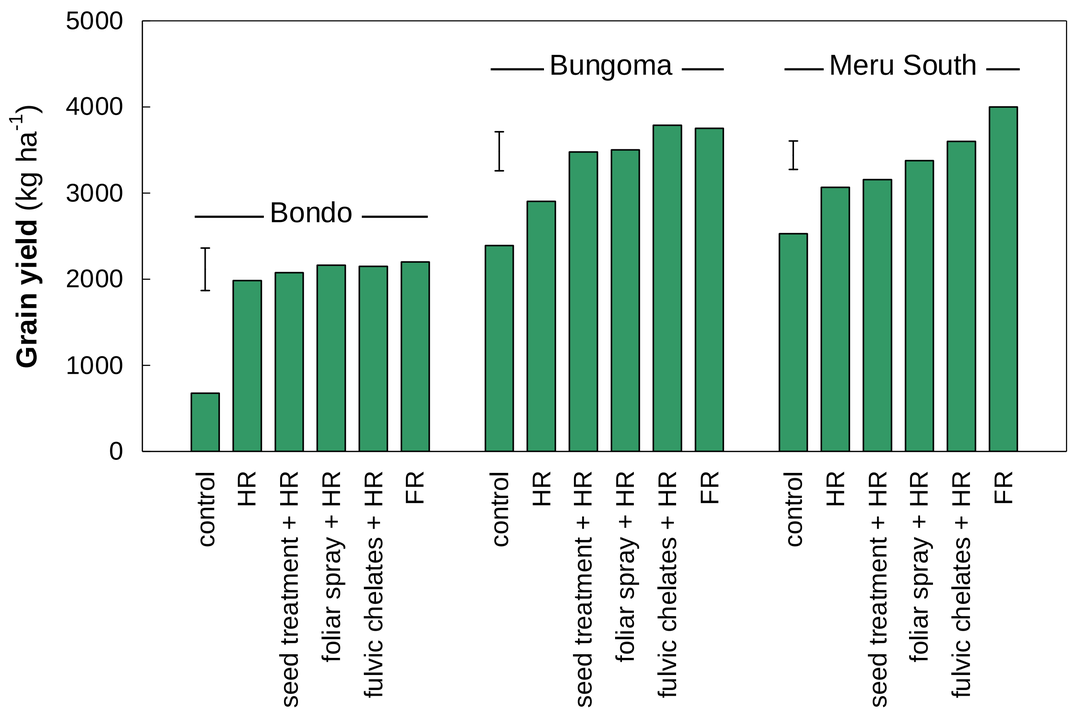


Results: pot trials



- Significant response to mineral P addition in both soils.
- Small positive but soil-specific effects of foliar P application and fulvic acid conditioners on shoot yield.
- Positive but soil-specific effect of seed P treatment on root yield.
- Conclusive evaluation of alternative P formulations requires field testing on maize grown for a complete cycle.

Results: field trials



- A significant response to TSP fertilizer was observed in all agro-ecological zones, but not beyond HR in Bondo. Consequently, alternative P formulations have no effect on maize grain yield in Bondo.
- Only application of the foliar spray and use of the fulvic acid conditioner have a positive effect on grain yield, which is larger in Bungoma than in Meru South.

Discussion

- Although positive effects of alternative P formulations on yield are found, profitability is questionable. Benefit-cost ratios vary between 1.9 and 3.7 for the use of foliar P fertilizer, and between 0.8 and 1.4 for the P concentrate with a fulvic chelate conditioner, without accounting for the added labour requirement to apply both products.
- Follow-up studies are needed to optimize (economic) rates of basal TSP fertilizer in combination with alternative P formulations.
- Further detailed measurements will be conducted to link positive effects of alternative P formulations to soil properties (esp. available P and soil P buffering capacity), and provide more site-specific recommendations.

This work was carried out in the framework of the project "*Evaluation and scaling up new chemical and biological commercial products for improving and sustaining crop yields in selected agro-ecological zones in sub-Saharan Africa*" [COMPRO], funded by the Bill and Melinda Gates Foundation. We are grateful to our collaborators and farmer group members who keenly participated in the field evaluation trials.